was carried out during the war period when the adequate examination of these products was a matter of such great importance. Although most of the methods dealt with have already been described either in technical journals or in the proceedings of technical societies, chemists will welcome the accumulation of this information within the covers of one volume. Moreover, the admirable summary of "The Constituents of Coal-tar and their Properties," compiled by Dr. Spielman, appears in a revised form as an appendix, and the inclusion of this information may prove useful to the coke-oven chemist by saving reference work.

The rest of the book is disappointing. In describing analytical methods the author has obviously attempted to do more than supply indications of the method recommended by him, but has failed to furnish sufficient detailed information to be of real service to the works chemist.

The chapter dealing with the fractions of coal-tar other than the naphtha fraction is meagre, and the weakness of this section accentuates the fact that chemists have not yet given adequate study to the analytical methods required in the examination of the heavier fractions of coal-tar, which are no less important than the naphtha distillate. It is in this section of the book that a recommendation appears which would have shocked those older and well-established chemists who attempted to teach us our subject, and who, not living in these times of efficiency systems and labour-saving devices, paid due reverence to instruments by which accurate measurements might be made. The recommendation refers to the crystallisation of crude tar acids, the instructions being to cool the liquid, "stirring continually with a Fahrenheit thermometer graduated in tenths of a degree."

The treatment accorded in other sections of the book to the analysis of gases, calorimetry, and the examination of chemical products made and required in the recovery works is all too brief. The analysis of coal-gas, which is acknowledged to be so intricate as to require considerable experience before trustworthy results can be expected, is dealt with in a few pages, whilst the method of procedure recommended is archaic. The estimation of naphthalene is carried out by a method which would be quite unpractical if small quantities of ammonia were present in the gas, though no mention is made of this fact.

Finally, the manual contains the usual collection of tables and conversion factors in the second appendix—so useful to reader, author, and publisher. E. V. EVANS.

Lichens.

(1) *Lichens.* By A. L. Smith. (Cambridge Botanical Handbooks.) Pp. xxviii + 464. (Cambridge: At the University Press, 1921.) 55s. net.

(2) *A Handbook of the British Lichens.* By Annie Lorrain Smith. Pp. vii + 158. (London: The British Museum (Natural History), 1921.) 6s. 6d.

(1) FOR many years botanists have been without a guide to the large mass of facts that have been added year by year to our knowledge of lichens. Miss A. Lorrain Smith has therefore done a good work in compiling a very comprehensive handbook on this group of plants. The growth of our manufacturing and even our garden cities proves fatal to all except a few insignificant lichens. They are driven away to those far-off parts of the country where the air is still fresh and pure. This circumstance very possibly, but the absence of any comprehensive handbook on, and guide to, the lichens certainly, is a reason why so little interest is taken in this group. Yet, ecologically, it is one of the most interesting groups. Lichens grow on the outskirts of vegetation, as pioneers of the plant world, preparing the way for moss, fern and flowering plant. They are most intimately in touch with the substratum in its virgin condition. Few ecologists, however, properly consider lichens. Anatomically, the lichen thallus very directly reflects the nature of the substratum. A great deal, however, still remains to be done in this direction. The elaborate and careful work of the late Abbé Hue has, unfortunately, not brought much morphological order into our knowledge of lichen structure.

The whole question of the dependence of one organism, whether animal or plant, on another, or even others, again whether animal or plant, is every day becoming of greater interest. The views of various lichenologists on this matter are placed before us by Miss Lorrain Smith, but the simple word symbiosis is the term most favoured. It does not define the relationship between alga and fungus in too great a detail. Terms like helotism (due, by the way, to Warming and not to Nienburg), parasitism, consortium, endosaprophytism, and others, may cover certain individual cases, but the relationship of alga to fungus certainly varies in different species, or possibly even in different individuals of one species growing under different conditions. There is no doubt that on the whole the lichen-fungus fully controls growth and reproduction of the gonidial algæ,

© 1922 Nature Publishing Group

though within certain limits both take place freely. Lindau, however, has described how in certain hypophlœodic lichens the alga actually forges ahead of the fungus.

The various branches of the subject have been very fully dealt with by Miss Lorrain Smith, but we think that not sufficient reference has been made to Exsiccata, which have played such an important part in lichenological nomenclature. We also consider that the book as a whole is not well illustrated. Many of the line drawings are quite inadequate as illustrations in a handbook of this standard. The half-tone figure on p. 117 appears to us to be *Cladonia uncialis* rather than *Cladonia furcata,* whilst Fig. 135 on p. 416 does not recall to us *Parmelia omphalodes,* which it purports to represent. Apart from these blemishes, which we consider rather serious, the handbook is a storehouse of valuable information, and Miss Lorrain Smith deserves the thanks of all lichenologists and botanists for the care and thoroughness with which she has completed her task. Some readers might possibly object that they are left too much to draw general conclusions for themselves.

The price of the book, unfortunately, is prohibitive except for public and college libraries.

(2) We are sure that Miss Lorrain Smith's "Handbook of the British Lichens" will answer its purpose very well and help both botanist and collector to name their specimens, instead of being compelled to depend for this on foreign books. The book, however, is only a key to the "Monograph of the British Lichens," by Miss Lorrain Smith, the price of which, again, is well-nigh prohibitive. We may express the hope that this little book will help to create renewed interest in a group of plants the study of which was at one time keenly followed in this country.

O. V. D.

British Mineral Resources.

Memoirs of the Geological Survey. Special Reports on the Mineral Resources of Great Britain. Vol. 19, *Lead and Zinc Ores in the Carboniferous Rocks of North Wales.* By Bernard Smith. Pp. iv + 162 + 3 plates. 1921. 5*s.* 6*d.* net. Vol. 21, *Lead, Silver-lead, and Zinc Ores of Cornwall, Devon, and Somerset.* By Henry Dewey. Pp. iv + 72. 1921. 2*s.* 6*d.* net. (Southampton: Ordnance Survey Office; London: E. Stanford, Ltd.)

THE two volumes under notice form an important contribution to our knowledge of British mineral deposits, and afford satisfactory evidence that Dr. Flett is continuing energetically the valuable series of reports inaugurated by his predecessor at the Geological Survey. The scheme of both volumes is identical and is upon the lines with which previous reports had already familiarised us, but the economic importance of the deposits discussed therein differs very widely. The lead and zinc veins of North Wales have not only been highly productive in the past, but also may well take rank in the future among the leading British lead-producing mines, whilst those of the south-west of England present little more than academic interest. Needless to say, none of the mines discussed in either volume is at work just now; in fact, in the whole of Great Britain there is not a single lead or zinc mine capable of working save at a loss at the present time, probably a result of Government interference in the control of industries.

In North Wales such well-known mines as the Halkyn mines and others in the Holywell-Halkyn area, the Minera mines and other adjoining mines in Denbighshire are fully described, together with numerous less important mining properties. It is abundantly clear that in all these cases the great difficulty to be overcome is the enormous influx of water, which has rendered the economic working of these mines practically impossible. An interesting account is given of the various deep adit drainage schemes by which it is proposed to unwater some of the more important mining areas down to a considerably greater depth than has hitherto been reached. Although he does not specifically say so, it would appear that Mr. Bernard Smith entertains no doubt of the ore holding down to the greatest depth that would thus be rendered available. Incidentally he shows that the 35,000*l.* which the Government advanced for unwatering the Halkyn area have been wasted and have never yielded any return whatever. It can only be hoped that some satisfactory scheme for unwatering this area may be devised and carried into execution, though it is difficult to see how this can be done until British lead-mining reaches a sounder economic position than that with which it is faced to-day.

As regards the lead mines in Cornwall, Devon, and the Mendip Hills, it can only be said that there is practically no likelihood at all of any serious revival of the lead-mining industry in these parts, and it is fortunate that the task of collecting information as to the past history of these mines has been undertaken before it is too late. Mr. Dewey has done a useful piece of work in carefully compiling an account of these mines, which will be especially interesting to the student of mineral deposition.

H. LOUIS.

© 1922 Nature Publishing Group